

STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION



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STATION NEWS
PUTTING SCIENCE TO WORK FOR SOCIETY

The mission of The Connecticut Agricultural Experiment Station is to develop, advance, and disseminate scientific knowledge, improve agricultural productivity and environmental quality, protect plants, and enhance human health and well-being through research for the benefit of Connecticut residents and the nation. Seeking solutions across a variety of disciplines for the benefit of urban, suburban, and rural communities, Station scientists remain committed to "Putting Science to Work for Society", a motto as relevant today as it was at our founding in 1875.



VOLUME 4, ISSUE 4

Departmental News

Administration	2
Analytical Chemistry	3
Entomology	4
Environmental Sciences	6
Forestry and Horticulture	5

APRIL 2014

Plant Pathology and Ecology	7
Valley Laboratory	8
Departmental Research Updates	9
Articles of Interest	12
Journal Articles Approved	14





STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

DEPARTMENTAL NEWS

ADMINISTRATION

DR. THEODORE ANDREADIS attended a meeting of the Northeast Regional Association of Experiment Station Directors, held in Baltimore, MD (March 10 – 12); hosted Mathew LaBeau, Research Aide and Outreach Organizer to Senator Richard Blumenthal, gave tour of CAES facilities and reviewed current research programs (March 18); attended Ag Day at the State Capital in Hartford (March 19); met with DEEP Deputy Commissioner, Mackey McCleary with **DR. RICHARD COWLES** to discuss policy on the use of neonicotinoid pesticides and its impact on honey bees and human health (March 20); presented an update on Station activities at the annual meeting of State Tree Wardens, held in Glastonbury (March 20); and organized and presided over a speaker program for the annual meeting of the Experiment Station Associates held in Hamden (40 attendees) (March 26).



Dr. Theodore Andreadis, Connecticut Governor Dannel Malloy, and Connecticut's Commissioner of Agriculture Steven K. Reviczky at Agriculture Day at the Capitol, March 19.



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

ANALYTICAL CHEMISTRY

DR. JASON C. WHITE attended the McIntire-Stennis Administrative-Technical Representatives annual meeting in Washington DC (March 4-5); attended the monthly Laboratory Preparedness Advisory Group Meeting at the CT Department of Public Health Laboratory in Rocky Hill, CT (March 10), along with **MS. KITTY PRAPAYOTIN-RIVEROS, MS. TERRI ARSENAULT, DR. BRIAN EITZER, MR. CRAIG MUSANTE, MR. JOHN RANCIATO, MR. MICHAEL CAVADINI, MR. JOSEPH HAWTHORNE, DR. WALTER KROL, AND DR. CHRISTINA ROBB** participated in the FDA ISO Accreditation Year 2 Quarter 2 teleconference call with Dr. Ruiqing Pamboukian and Dr. Anthony Adeuya of the US FDA (March 6); participated in the APHL Agricultural/Chemist Laboratories quarterly teleconference call (March 6); participated in an FDA MFRPS webinar (March 10); testified in front of the Finance, Revenue and Bonding Subcommittee at the Legislative Office Building in Hartford regarding the Valley Laboratory construction/renovation project (10 attendees) (March 11); chaired a quarterly meeting of the CAES Safety Committee (March 12); along with **MS. KITTY PRAPAYOTIN-RIVEROS, MS. TERRI ARSENAULT, DR. BRIAN EITZER, MR. CRAIG MUSANTE, MR. MICHAEL CAVADINI, DR. CHRISTINA ROBB, MR. JOSEPH HAWTHORNE, AND DR. WALTER KROL** participated in the monthly FDA FERN chemistry cooperative agreement program (cCAP) teleconference call (March 13); presented a seminar entitled "Environmental Implications of Nanotechnology" at the New Haven Chapter of the American Chemical Society (ACS) monthly meeting (15 attendees) (March 13); along with **MS. KITTY PRAPAYOTIN-RIVEROS, MS. TERRI ARSENAULT, DR. BRIAN EITZER, MR. CRAIG MUSANTE, MR. MICHAEL CAVADINI, DR. CHRISTINA ROBB, MR. JOSEPH HAWTHORNE, DR. WALTER KROL, DR. ROBERTO DE LA TORRE-ROCHE, DR. ALIA SERVIN AND DR. JOSE ANGEL HERNANDEZ-VIEZCAS** met with Intelligence Analyst Ms. Kate Bunting of the US Drug Enforcement Agency (DEA) (March 14); met with a Legislative Aid from Senator Richard Blumenthal's office (March 18); attended the Editorial Advisory Board meetings of *Environmental Science & Technology* and *Environmental Science & Technology Letters* in Dallas, TX (March 19-20); and along with **MS. KITTY PRAPAYOTIN-RIVEROS, MS. TERRI ARSENAULT AND DR. WALTER KROL** participated in an ISO 17025 Mentor/Mentee Conference Call with Ohio Department of Agriculture (March 27).

DR. BRIAN EITZER attended a seminar conducted by AB Sciex on new developments in forensic toxicology using LC/MS/MS at Yale Medical School (March 11); and judged the Connecticut Science and Engineering Fair held at Quinnipiac University (March 12-13).

MR. MICHAEL J. CAVADINI, with MR. GREGORY BUGBEE attended the 2014 CT Science Olympiad in Farmington, CT (March 22); proctored three sessions of Entomology exams (March 22); and attended the first day of the MFRPA conference in Fort Worth, TX and met with CT DCP officials (March 10).

DR. ROBERTO DE LA TORRE-ROCHE attended the 2014 American Chemical Society Conference in Dallas, TX (March 16-20); and gave a lecture entitled "Engineered nanomaterials and agricultural crops: Co-contaminant interactions and trophic transfer" (35 attendees) (March 17)

ENTOMOLOGY

MR. MARK H. CREIGHTON spoke at the Backyard Beekeepers Association meeting in Weston, making contact with approx. 75 members (March 25); spoke about starting a beekeeping program to Ag students at Northwestern Regional High School in Winsted (25 students attended) (March 26).

DR. LAURA E. HAYES, with DR. KIRBY C. STAFFORD III, met with the First Selectman and Health Officer in Redding, CT to discuss a new tick management study (5 attendees) (March 12).



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

ENTOMOLOGY

DR. CHRIS T. MAIER gave a talk titled “The 2013 Emergence of Periodical Cicadas in Connecticut” at the Forest Health Workshop at Fort Trumbull in New London (60 attendees) (March 4); and exhibited arthropod fossils at a meeting of the Connecticut Entomological Society in Storrs (30 attendees) (March 21).

DR. GALE E. RIDGE spoke about bed bugs and situations of social stress to the Connecticut Coalition Against Domestic Violence in Wethersfield (60 attendees) (March 19). CCABB launched two public service electronic billboards in Hartford on I-91; one on the southbound lane, next to the Colt building and the other on the northbound lane, on the Hartford/Windsor town line. They will be on display for one month (March 24). Dr. Ridge presented a two-hour workshop on bed bugs and management in institutions to the Bethsaida Community in Norwich (25 attendees) (March 26); and gave a talk on bed bugs at Southern Connecticut State University in New Haven (55 attendees) (March 26).



The bed bug public service electronic billboard launches on March 24th, southbound lane of I-91 near the Colt building, Hartford. Design by Katherine Dugas.

DR. CLAIRE E. RUTLEDGE presented a talk titled “The Death Curve: What Happens After EAB Arrives” at the Forest Health Workshop held at Fort Trumbull State Park in New London (60 adult attendees) (March 4); staffed the CAES booth at Agriculture Day at the Capitol in Hartford (March 19); and presented a talk titled “Emerald Ash Borer in Connecticut” at the annual meeting of the Experiment Station Associates in Hamden (45 adults) (March 26).

DR. VICTORIA L. SMITH organized and participated in the annual Forest Health Workshop, held at Fort Trumbull State Park Conference Center, New London. There were 12 presentations by scientists from CAES and University of Connecticut on topics of interest to foresters and arborists (60 attendees) (March 4); and participated in a workshop on the new Federal Order concerning *Phytophthora ramorum*, held at the USDA-APHIS-Plant Protection and Quarantine Office in Wallingford (March 26).



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

DR. KIRBY C. STAFFORD III spoke on the Emerald ash borer and firewood regulations at the Forest Health Workshop in New London (60 attendees) (March 4); spoke on landscape management for tick control for the national NPMA Pestworld webinar "Principals of Tick Management and Tick-Borne Disease" (430 attendees) (March 5); was interviewed about cold temperatures and its impact on invasive insects by Patrick Skahill, WNPR radio (March 6); spoke on tick bite prevention and insect repellents at the Southbury Garden Club (27 attendees) (March 7); with **DR. LAURA E. HAYES**, met with the First Selectman and Health Officer in Redding, CT to discuss a new tick management study (5 attendees) (March 12); was interviewed about the tick study in Redding, CT by Greg Hladky, Hartford Courant (March 24); was interviewed about ticks and Lyme disease by Kathy Connolly for The Day and Lawn & Garden magazine (March 31); was interviewed about the reservoir targeted Lyme disease bait study that will be carried out in Redding, CT by Bob Miller, Danbury News Times (March 31); and was interviewed about the reservoir targeted Lyme disease bait study that will be carried out in Redding, CT by Judy Benson, The Day (March 31).

DR. KIMBERLY A. STONER presented two workshops titled "The Future of Honey Bees, Wild Bees, and Pollination, and What You Can Do" (55 attendees) and "Lead and Arsenic in Soil: Where Is It and What Can You Do About It?" (35 attendees) at the CT NOFA Winter Conference held at Western Connecticut State University in Danbury (March 1); spoke on "The Future of Honey Bees, Wild Bees, and Pollination, and What You Can Do" at a meeting of the Land Heritage Association of Glastonbury held at the South Glastonbury Public Library (65 attendees) (March 4); participated in a meeting of the Urban Agriculture Working Group held at New Haven City Hall (12 attendees) (March 12); spoke on "The Future of Honey Bees, Wild Bees, and Pollination, and What You Can Do" to the Branford Land Trust at the Branford Public Library (52 attendees) (March 26).

MS. TRACY ZARRILLO gave a talk and workshop on "Bumble Bees of Connecticut" at a meeting of the Connecticut Entomological Society held at UConn in Storrs (30 adult attendees) (March 21).

ENVIRONMENTAL SCIENCES

DR. JOSEPH J. PIGNATELLO met with Professor Dion Dionysious, Department of Chemical Engineering, University of Cincinnati to discuss overlapping research interests (March 5).

DR. GOUDARZ MOLAEI presented an invited talk titled "Eastern Equine Encephalitis Virus: Knowns and Unknowns" to the New Jersey Mosquito Control Association, Atlantic City (March 5); was interviewed by telephone by Santa Clara University on his research on West Nile and other mosquito-borne arboviruses to prepare a podcast (March 11); and accepted an invitation to serve as the external advisor for Wan Nurul Naszeerah an MPH, student at the Yale School of Public Health.

DR. PHILIP ARMSTRONG was interviewed on mosquitoes and mosquito-borne illnesses for WIHS, Healthline Radio Show (March 11); spoke to a group of 23 students and 1 teacher from Park City Prep Charter School, Bridgeport about the CAES's mosquito surveillance program as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (March 12); and spoke to the Granby Land Trust in East Granby about the history and impact of West Nile virus in Connecticut (March 18).

MR. GREGORY BUGBEE with **MS. JORDAN GIBBONS**, gave a seminar entitled "Identification of Banned Aquatic Plants in the Aquarium Trade" to Department of Agriculture inspectors at the DOAg Building in Hartford (5 attendees) (March 5); gave a talk entitled "The Battle for Candlewood Lake: Can the Invaders be Stopped?" at the Connecticut Conference on Natural Resources at the UCONN campus in Storrs (40 attendees) (March 17); gave a talk entitled "Improving Soil in the Home Garden" to the Bridgeport Men's Garden Club in Stratford (20 attendees) (March 16); participated in the Northeast Lake Classification Steering Committee



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

online meeting (March 20); with **MICHAEL CAVADINI**, proctored the Entomology event at the Connecticut Science Olympiad in Farmington (50 attendees) (March 22); participated in the PA-12-155 Nonpoint Source Phosphorus Subcommittee meeting at CTDEEP headquarters in Hartford (March 24); and spoke to the Experiment Station Associates on "Connecticut's Invasive Aquatic Plant Problem – Searching for Solutions" at the Whitney Center in Hamden (50 attendees) (March 26)

MR. JOHN SHEPARD, along with **MR. MICHAEL THOMAS** conducted a hands-on workshop on mosquito biology to a group of 23 students and 1 teacher from Park City Prep Charter School in Bridgeport as part of the Yale-Peabody Fellows SEPA NIH program on mosquito biology (March 12); and attended a meeting of the Board of Directors of the Northeastern Mosquito Control Association in Brewster, MA (11 attendees) (March 14).

DR. CHARLES VOSSBRINCK held a meeting of home gardeners interested in propagating figs and demonstrated potting of dormant cuttings in various rooting media (8 attendees) (March 29).

MS. JORDAN GIBBONS with **MS. SAMANTHA WYSOCKI** gave a table demonstration on how to identify invasive aquatic plants in Connecticut at the "Last Green Valley" Volunteer appreciation event at the Audubon society in Pomfret (40 attendees) (March 7); and spoke on government career opportunities in the field of environmental science at Westfield State University's Environmental Science Career Networking Night in Westfield, MA (75 attendees) (March 19).

FORESTRY AND HORTICULTURE

DR. JEFFREY WARD spoke on "Stormwise" roadside forest management at the Forest Health Monitoring Workshop in New London (60 attendees) (March 4); spoke on "Trophic level interactions: deer, invasives, and native plants" for the Forest Ecosystems Health class at Yale University (12 attendees) (March 6); administered practical and oral examinations to arborist candidates for the Connecticut Tree Protection Examining Board (March 12); was interviewed about signs of spring in the forest by Judy Benson of the New London Day (March 16); spoke on "Right tree-Right Place" for the public works directors, Naugatuck Valley Council of Governments (11 attendees) (March 19); attended the annual winter meeting of the New England Society of American Foresters in Nashua, NH (March 25-27); and spoke on oak regeneration and black birch management of NESAF field trip in Hudson, NH (42 attendees) (March 27).

DR. ABIGAIL MAYNARD spoke on "Unusual Garden Vegetables" as part of the Spring Gardening Lecture Series at the Milford Public Library (72 attendees) (March 24); visited and discussed the New Crops Program at Hindinger's Farm in Hamden and Viuso's farm in Branford (March 27).

DR. SCOTT WILLIAMS interviewed by local outdoor writer Edward Ricciuti about ticks and tick-borne disease along the Connecticut Shoreline (March 5); attended the Connecticut Conference on Natural Resources at Storrs (March 17); interviewed by Greg Hladky, Hartford Courant blogger, about white-tailed deer abundance and trends in Connecticut (March 18); spoke on "Reducing Tick Abundance by Recreational Deer Hunting-Is It Possible?" at the Annual Meeting of the Connecticut Agricultural Experiment Station Associates in Hamden (40 attendees) (March 26); attended the quarterly meeting of the Connecticut Agricultural Experiment Station's Institutional Animal Care and Use Committee (March 27); gave invited lecture at the headquarters of the Stewart B. McKinney National Wildlife Refuge titled "TICKED OFF!: Invasive Plants and Lyme Disease – A Surprising Connection" in Westbrook (15 attendees) (March 27); and participated in an executive committee meeting of the Connecticut Urban Forest Council in New Haven (March 28).

MR. JOSEPH BARSKY presented a research poster and abstract "Integrating forest and roadside management objectives to create storm resilient forests" at the 94th Annual Winter Meeting of the New England Society of American Foresters in Nashua, NH (400 attendees) (March 25-27).



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

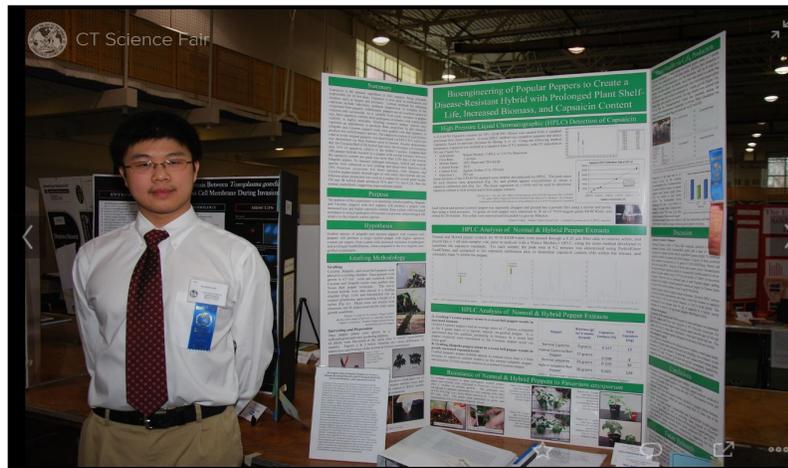
PLANT PATHOLOGY AND ECOLOGY

DR. SANDRA L. ANAGNOSTAKIS gave a talk titled “Chestnut Gall Wasp” at the annual Forest Health Monitoring Workshop held at Fort Trumbull State Park in New London (60 attendees) (March 4).

DR. DONALD E. AYLOR participated as a judge for the Finalist High School Physical Sciences projects at the Connecticut Science Fair held at Quinnipiac University (spoke with 20 youths and 10 adults) (March 13).

DR. SHARON M. DOUGLAS gave a presentation titled “Key Root Rot Diseases of Christmas Tree Plantations” and participated in the Annual Meeting of the CT Christmas Tree Growers Association in Middletown (120 attendees) (March 1); and participated in the March meeting of the CT Tree Protection Examining Board and helped administer the oral exam to candidates for the arborist license (March 12).

DR. WADE H. ELMER was visited by Dr. Rosa Rodales, the new extension greenhouse specialist from UConn, to discuss future projects (March 4); attended the Connecticut Conference on Natural Resources and presented the paper “Influence of Nitrogen and Silicon on *Spartina alterniflora* and Its Possible Role in Marsh Dieback” at UConn in Storrs (18 attendees) (March 17).



Andrew Lim, mentored by **Dr. Wade Elmer**, won an award for his 10th grade project titled “Bioengineering of Populus Peppers to Create a Disease-Resistant Hybrid with Prolonged Shelf-Life, Increased Biomass, and Capsaicin Content” at the Connecticut Science & Engineering Fair held March 11-15 at Quinnipiac University in Hamden.

DR. FRANCIS J. FERRANDINO participated in the CT Wine Council Meeting held in Hartford. It was decided that for wines to have a CT-Grown label, they should contain at least 51% CT-grown grapes (March 21).

DR. YONGHAO LI talked about “Organic Vegetable Disease Management” at the CT NOFA’s 32nd Annual Winter Conference in Danbury (60 attendees) (March 1); gave a talk titled “New Strain of White Pine Blister Rust: Increased Threat to CT Forests?” at the annual Forest Health Workshop held at Fort Trumbull State Park in New London (60 attendees) (March 4); and staffed the “hands-on” table with tree diseases for the Arboriculture 101 course in Wallingford (40 attendees) (March 5).

DR. ROBERT E. MARRA presented a talk titled “Elm Yellows Diagnostics: Challenges and Capabilities” at the Forest Health Workshop held at Fort Trumbull State Park in New London (60 attendees) (March 4); and presented a talk titled “Nondestructive Quantification of Internal Decay in Living Trees” at the annual meeting of the Experiment Station Associates held at Whitney Center in Hamden (March 26).



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

VALLEY LABORATORY

DR. CAROLE CHEAH presented a talk on the effects of the polar vortex on hemlock woolly adelgid and elongate hemlock scale at the 2014 Forest Health Monitoring Workshop at Fort Trumbull State Park, New London (March 4); and was interviewed by Patrick Skayhill for WNPR Connecticut Public Radio (March 6) on the effects of 2014 cold winter on the status of hemlock woolly adelgid in Connecticut; and was awarded an APHIS cooperative agreement for 2014 for biological control of mile-a-minute weed with the weevil, *Rhinoncomimus latipe*.

DR. RICHARD COWLES presented "Managing Root Rots in Christmas Trees," to the annual meeting of the Connecticut Christmas Tree Growers Association, Middletown (100 participants) (March 1); talked about "Annual bluegrass weevils and white grubs in turf: Time to change your strategies?" (100 attendees) (March 5), and "Choosing appropriate turf insecticides," (30 attendees) (March 6) to the New England Regional Turf Association meeting, Providence, RI.; presented "Why mass trapping SWD fails" at the Eastern Branch Meeting of the Entomological Society of America meeting, Williamsburg, VA (60 attendees) (March 16); discussed "Neonicotinoids and management of SWD," at a Red Tomato (a produce cooperative) meeting, Annandale-on-Hudson (25 attendees) (March 19); and participated in a meeting with Mr. McCleary, Deputy Commissioner of DEEP, **DR. THEODORE ANDREADIS**, and others regarding the use of neonicotinoid insecticides and their associated risks to pollinators, Hartford (5 attendees) (March 20).

MS. ROSE HISKES gave a talk on "Invasive Plants" to the Redding Garden Club and Conservation Commission in Redding (52 attendees) (March 10).

DR. JAMES LAMONDIA spoke about research and services at the Station and Valley Laboratory summer employment opportunities at the Central Connecticut State University Biology Department Career Fair (70 attendees) (March 10); examined candidates for the Connecticut arborist license and participated in the quarterly meeting of the Connecticut Tree Protection Examining Board in New Haven (March 12); and participated in Agriculture Day at the Capitol, speaking about the 2013 Century Farm Award and Holmberg Orchards (100 people) (March 19).

DR. DE-WEI LI participated in an Occupational Health Forum: Building Partnerships Towards Healthy Connecticut Workers on March 27, 2014, at the Manor Inn, Plantsville, CT. Thirty nine people attended the meeting; and participated in the first meeting of the advisory board and research team for "Recovery from Catastrophic Weather -Hurricane Sandy: Mold Exposure and Health-Related Training project" at the UCONN Health Center, Center for Indoor Environments and Health in Farmington, CT (March 28). De-Wei is serving as an advisor for the project. During the meeting participants discussed the objectives and DRAFT Interview/Focus Group Script. Fifteen people participated the meeting.

DR. TODD L. MERVOSH participated in a symposium planning meeting for the Conn. Invasive Plant Working Group (March 3); and spoke to the Easton Garden Club about the biology and management of invasive plants (25 attendees) (March 12).



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

DEPARTMENTAL RESEARCH UPDATES MARCH 2014

Petersen, E.J.; Henry, T.B.; Zhao, J.; MacCuspie, R.I.; Kirschling, T.L.; Dobrovolskaia, M.A.; Hackley, V.; Xing, B.; **White, J.C.** 2014. Identification and avoidance of potential artifacts and misinterpretations in nanomaterial ecotoxicity measurements. *Environ. Sci. Technol.* DOI: 10.1021/es4052999.

ABSTRACT: Novel physicochemistries of engineered nanomaterials (ENMs) offer considerable commercial potential for new products and processes, but also the possibility of unforeseen and negative consequences upon ENM release into the environment. Investigations of ENM ecotoxicity have revealed that the unique properties of ENMs and a lack of appropriate test methods can lead to results that are inaccurate or not reproducible. The occurrence of spurious results or misinterpretations of results from ENM toxicity tests that are unique to investigations of ENMs (as opposed to traditional toxicants) have been reported, but have not yet been systemically reviewed. Our objective in this manuscript is to highlight artifacts and misinterpretations that can occur at each step of ecotoxicity testing: procurement or synthesis of the ENMs and assessment of potential toxic impurities such as metals or endotoxins, ENM storage, dispersion of the ENMs in the test medium, direct interference with assay reagents and unacknowledged indirect effects such as nutrient depletion during the assay, and assessment of the ENM biodistribution in organisms. We recommend thorough characterization of initial ENMs including measurement of impurities, implementation of steps to minimize changes to the ENMs during storage, inclusion of a set of experimental controls (e.g., to assess impacts of nutrient depletion, ENM specific effects, impurities in ENM formulation, desorbed surface coatings, the dispersion process, and direct interference of ENM with toxicity assays), and use of orthogonal measurement methods when available to assess ENMs fate and distribution in organisms.

Hamdi, H.; **De La Torre-Roche, R.; Hawthorne, J.; White, J.C.** 2014. Impact of non-functionalized and amino-functionalized multiwall carbon nanotubes on pesticide uptake by lettuce (*Lactuca sativa* L.). *Nanotox.* DOI: 10.3109/17435390.2014.907456.

ABSTRACT: The effect of nonfunctionalized and amino-functionalized multiwall carbon nanotube (CNT) (NF-MWCNT, NH₂-MWCNT) exposure, as well as the impact of CNT presence on coexistent pesticide accumulation, was investigated in lettuce (*Lactuca sativa* L.). Lettuce seeds were sown directly into CNT-amended vermiculite (1000 mg L⁻¹) to monitor phytotoxicity during germination and growth. During growth, lettuce seedlings were subsequently exposed to chlordane (cis-chlordane, trans-chlordane, trans-nonachlor) and *p,p'*-DDE (all at 100 ng/L) in the irrigation solution for a 19-d growth period. CNT exposure did not significantly influence seed germination (82-96%) or plant growth. Similarly, pesticide exposure had no impact on plant growth, total pigment production or tissue lipid peroxidation. After 19 d, the root content of total chlordane and *p,p'*-DDE was 390 and 73.8 µg g⁻¹, respectively, in plants not exposed to CNTs; the shoot levels were 1.58 and 0.40 µg g⁻¹, respectively. The presence and type of CNT significantly influenced pesticide availability to lettuce seedlings. Nonfunctionalized CNT decreased the root and shoot pesticide content by 88% and 78%, respectively, but amino-functionalized CNT effects were significantly more modest, with decreases of 57% in the roots and 23% in the shoots, respectively. The presence of humic acid completely reversed the reduced accumulation of pesticides induced by amino-functionalized CNT, likely due to strong competition over adsorption sites on the nanomaterial. These findings have implications for food safety and for the use of engineered nanomaterials in agriculture, especially with leafy vegetables.



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

Gent, M.P.N. 2014. Effect of daily light integral on composition of hydroponic lettuce. *HortScience* 42:173-179

ABSTRACT: The concentrations of metabolites in plants are affected by sunlight integral and other factors such as plant size, water content, and time of day. Tissue composition was measured for various sizes of hydroponic lettuce (*Lactuca sativa* L.) grown under seasonal variation in sunlight in a greenhouse and harvested in the morning or afternoon. Daily sunlight integral varied from 4 to 14 mol m⁻² day⁻¹ photosynthetically active irradiance, and plant size varied from 2 to 260 g fresh weight (FW)/plant in this study. Much of the variation in tissue composition on a FW basis could be explained by the increase in dry matter content with irradiance normalized per unit area. Except for nitrate, metabolite concentrations on a FW basis increased with irradiance, and the changes resulting from irradiance were greater when harvested in the afternoon than in the morning. Nitrate concentration decreased with normalized irradiance, and the trend was the same whether measured in morning or afternoon. Malic acid increased with irradiance but not enough to counter the decrease in nitrate on a charge equivalence basis. Irradiance normalized per unit leaf area explained many effects of light and plant size on dry matter content and soluble metabolite concentrations. Lettuce for human consumption is best harvested in the afternoon after growth under high light, when it has the least nitrate and more of other nutrients.

F. Xiao and J. Pignatello, Effect of Adsorption Nonlinearity on the pH-Adsorption Profile of Ionizable Organic Compounds, *Langmuir* 30, 1994-2001 (2014).

ABSTRACT: Solution pH is an important factor in the adsorptive behavior of ionizable organic compounds (IOCs) in many industrial, commercial and environmental contexts. A linear speciation model (LSM) that assumes concentration-independent adsorption of charged and neutral species is often employed to model the pH-adsorption profile (edge). Deviations from that model—including shift of the adsorption edge from its expected inflection point at pH = pK_a and the appearance of an adsorption maximum (“hump”) near the pK_a—are sometimes used to infer mechanism. We investigated adsorption of six organic acids and bases on the non-functionalized, extremely low variable-charge surface of graphite. Isotherms at constant pH of both charged and neutral species were usually highly nonlinear, and the adsorption edges typically showed a shift, hump or both. We postulate that this behavior is due to the gradual extinction of the dissolved neutral or charged species as the pH approaches and then crosses the pK_a. This leads to an increase in the affinity of that species for the solid due to the inherent nonlinearity of its isotherm. Extinction of the more strongly-adsorbing species mainly causes the shift, while extinction of the less strongly-adsorbing species gives rise to the hump. A nonlinear speciation model (NSM) based on Freundlich or Langmuir equations was employed to fit the adsorption edge. The NSM captured both the shift and the hump and was superior to the LSM. Increasing adsorption nonlinearity of the neutral species shifts the adsorption edge in the acidic direction (organic bases) or alkaline direction (organic acids); whereas increasing nonlinearity of the charged species increases the hump size. Both shift and hump size increase with the difference in adsorption affinity between neutral and charged species. The results show that concentration-dependence alone can strongly affect the shape of pH-adsorption curve, and should be taken into account in future modeling.



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

Y. Yang, **J. J. Pignatello**, J. Ma, and W.A. Mitch, Comparison of Halide Impacts on the Efficiency of Contaminant Degradation by Sulfate and Hydroxyl Radical-Based Advanced Oxidation Processes (AOPs), *Environ. Sci. Technol.*, 48 (4), 2344–2351 (2014).

The effect of halides on organic contaminant destruction efficiency was compared for UV/H₂O₂ and UV/S₂O₈²⁻ AOP treatments of saline waters; benzoic acid, 3-cyclohexene-1-carboxylic acid, and cyclohexanecarboxylic acid were used as models for aromatic, alkene, and alkane constituents of naphthenic acids in oil-field waters. In model freshwater, contaminant degradation was higher by UV/S₂O₈²⁻ because of the higher quantum efficiency for S₂O₈²⁻ than H₂O₂ photolysis. The conversion of [•]OH and SO₄^{•-} radicals to less reactive halogen radicals in the presence of seawater halides reduced the degradation efficiency of benzoic acid and cyclohexanecarboxylic acid. The UV/S₂O₈²⁻ AOP was more affected by Cl⁻ than the UV/H₂O₂ AOP because oxidation of Cl⁻ is more favorable by SO₄^{•-} than [•]OH at pH 7. Degradation of 3-cyclohexene-1-carboxylic acid, was not affected by halides, likely because of the high reactivity of halogen radicals with alkenes. Despite its relatively low concentration in saline waters compared to Cl⁻, Br⁻ was particularly important. Br⁻ promoted halogen radical formation for both AOPs resulting in ClBr[•], Br₂^{•-}, and CO₃^{•-} concentrations orders of magnitude higher than [•]OH and SO₄^{•-} concentrations and reducing differences in halide impacts between the two AOPs. Kinetic modeling of the UV/H₂O₂ AOP indicated a synergism between Br⁻ and Cl⁻, with Br⁻ scavenging of [•]OH leading to BrOH^{•-}, and further reactions of Cl⁻ with this and other brominated radicals promoting halogen radical concentrations. In contaminant mixtures, the conversion of [•]OH and SO₄^{•-} radicals to more selective CO₃^{•-} and halogen radicals favored attack on highly reactive reaction centers represented by the alkene group of 3-cyclohexene-1-carboxylic acid and the aromatic group of the model compound, 2,4-dihydroxybenzoic acid, at the expense of less reactive reaction centers such as aromatic rings and alkane groups represented in benzoic acid and cyclohexanecarboxylic acid. This effect was more

Elmer, W. H. 2014. A tripartite interaction between *Spartina alterniflora*, *Fusarium palustre* and the purple marsh crab (*Sesarma reticulatum*) contributes to Sudden Vegetation Dieback of salt marshes in New England. *Phytopathology* DOI: <http://dx.doi.org/10.1094/PHYTO-08-13-0219-R>.

ABSTRACT: Tripartite interactions are common and occur when one agent (an arthropod or pathogen) changes the host plant in a manner that alters the attack of the challenging agent. We examined herbivory from the purple marsh crab (*Sesarma reticulatum*) on *Spartina alterniflora* following exposure to drought and/or inoculation with *Fusarium palustre* in meocosms in the greenhouse and in crab-infested creek banks along intertidal salt marshes. Initially, drought stress on *S. alterniflora* and disease from *F. palustre* were examined in the greenhouse. Then a second challenger, the purple marsh crab, was introduced to determine how drought and disease from *F. palustre* affected the attraction and consumption of *S. alterniflora*. Plant height and shoot and root weights were reduced in plants subjected to severe drought treatment when compared to normally irrigated (plants). When the drought treatment was combined with inoculation with *F. palustre*, plants were significantly more stunted and symptomatic, had less fresh weight, more diseased roots, and a greater number of *Fusarium* colonies growing from the roots ($P < 0.001$) than non-inoculated plants. The effects were additive and statistical interactions were not detected between drought and inoculation. Estimates of herbivory (number of grass blades cut or biomass consumption) by the purple marsh crab were significantly greater on drought-stressed, diseased plants than on healthy plants irrigated normally. Drought increased attraction to the purple marsh crab more than inoculation with *F. palustre*. However, when only mild drought conditions were imposed, plant consumption was greater on inoculated plants. Healthy non-stressed transplants set into plots in crab-infested intertidal creek banks were grazed less each year than inoculated plants and/or plants that were exposed to drought. Several hypotheses relating to nutrition, chemotaxis, and visual attraction are presented to explain how stress from drought or disease might favor herbivory.



STATION NEWS

THE CONNECTICUT AGRICULTURAL EXPERIMENT STATION

GRANTS AWARDED MARCH 2014

James LaMondia and Victor Triolo received a Connecticut Department of Agriculture Agricultural Viability Grant for low trellis hop trials for two years for a total of \$45,960.

JOURNAL ARTICLES APPROVED MARCH 2014

Anagnostakis, S. L. Asian chestnut gall wasp on Connecticut chestnut trees. *CAES Fact Sheet*

Anagnostakis, S. L. Chestnut breeding in the United States. *CAES Fact Sheet*

Collin, Auffan, Johnson, Kaur, Keller, Lazareva, Lead, Ma, Merrifield, Svendsen, **White**, Unrine. Environmental release, fate, and ecotoxicological effects of manufactured ceria nanomaterials. *Environmental Science: Nano*.

Dingman, D. Comparative analysis of *Paenibacillus* larvae genotypes isolated in Connecticut. *Journal of Invertebrate Pathology*

LaMondia, J.A. Management of Lesion and Dagger Nematodes with Rotation Crops. *Journal of Nematology*.

LaMondia, J.A. First Report of Forsythia Shoot Blight Caused by *Phytophthora nicotianae* in Connecticut. *Plant Disease*.

Maynard, A. A. Growing Belgian endive and globe artichokes in Connecticut. *Connecticut Gardener*.

Rapp, M., Schein, J., Hunt, K.A., Mourad, G.S., **Schultes, N.P.**, *Zea mays* and *Setaria viridis* NCSI redefine the plant specific recognition profile for NSCI. *Journal of Plant Physiology*.

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